

(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 013 291 A1

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:

28.06.2000 Bulletin 2000/26

(51) Int. Cl.<sup>7</sup>: A61L 15/58, A61L 15/60

(21) Application number: 99125404.6

(22) Date of filing: 20.12.1999

(84) Designated Contracting States:  
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE  
Designated Extension States:  
AL LT LV MK RO SI

(30) Priority: 21.12.1998 US 217318

(71) Applicant: McNEIL-PPC, INC.  
Skillman, New Jersey 08558 (US)

(72) Inventor: Luizzi, Joseph  
Newton, PA 18940 (US)

(74) Representative:  
Groening, Hans Wilhelm, Dipl.-Ing.  
BOEHMERT & BOEHMERT  
Franz-Joseph-Strasse 38  
80801 München (DE)

### (54) Hot melt adhesive comprising an absorbent

(57) A hot-melt adhesive containing fluid absorbing polymers and non-absorbing polymers is optionally blended with super-absorbent polymers. The resulting thermoplastic hot-melt adhesive material can be used to adhesively bond substrates such as polymeric films together, as well as, to provide additional liquid absorption capacity to non-woven fabrics or absorbent structures. This adhesively coated material is particularly useful in the construction of absorbent products such as catamenial devices, wound dressings, bandages, and diapers and the like.

103

EP 1 013 291 A1

Description

FIELD OF THE INVENTION

5 [0001] The present invention relates to a novel adhesive and more particularly to a hot-melt adhesive which is capable of absorbing liquids.

BACKGROUND OF THE INVENTION

10 [0002] Absorbent articles such as catamenial pads, diapers, bandages, nursing pads and the like generally contain an absorbent element. The absorbent element of conventional disposable articles is typically formed from a fiberized wood pulp fluff or absorbent non-woven and/or other synthetic or natural absorbent materials such as peat moss or super-absorbent polymers. The absorbent element is covered with a soft, flexible liquid permeable topsheet which allows body fluid to be absorbed into the fluid retaining absorbent element. Typically a fluid impermeable backsheet is 15 adhesively affixed to the liquid permeable topsheet around a peripheral edge margin to form a flange seal and thereby fully enclose the absorbent element to prevent fluid leakage.

[0003] Hot melt adhesives are typically used in the construction of absorbent articles to attach the liquid permeable topsheet to the absorbent element and also to attach the fluid impermeable backsheet to the element. In addition, hot melt adhesives are also used in the construction of the absorbent structures to laminate multiple plies together or to 20 adhesively affix absorbent particles to a non-woven fabric or fibrous pulp.

SUMMARY OF THE INVENTION

25 [0004] It is an object of the present invention to provide a hot-melt adhesive which is capable of absorbing aqueous liquids.

[0005] It is another object of the present invention to provide a hot melt adhesive that eliminates the risk of super absorbent particles causing pinholes in a barrier backsheet when the absorbent article has been subjected to embossing or channeling.

30 [0006] It is another object of the present invention to provide a hot melt adhesive that eliminates the need to handle powders during the application of super absorbent particles to absorbent products.

[0007] It is another object of the present invention to provide a hot melt adhesive which enables superabsorbent particles to be pattern coated onto a substrate.

[0008] It is another object of the present invention to provide a hot melt adhesive which also functions as a fluid retaining system.

35 [0009] In accordance with the present invention, there has been provided a novel hot-melt adhesive that is capable of absorbing aqueous liquids which comprises:

40 | about 10% to about 50% of a block copolymer;  
| about 20% to about 80% of a tackifying resin; and  
| about 1% to about 60% of an aqueous liquid-absorbing polymer.

[0010] Also provided in accordance with the present invention is an absorbent article, the absorbent article comprising a liquid permeable topsheet, a liquid impermeable barrier sheet, an absorbent element between the topsheet and the barrier sheet, wherein either the topsheet or the barrier sheet is adhered to the absorbent element with a hot melt adhesive which further comprises:

45 about 10% to about 50% of a block copolymer;  
about 20% to about 80% of a tackifying resin; and  
about 1% to about 60% of an aqueous liquid-absorbing polymer.

50 [0011] Also provided in accordance with the present invention is an absorbent article, the absorbent article comprising a liquid permeable topsheet, a liquid impermeable barrier sheet, an absorbent element between the topsheet and the barrier sheet, wherein at least a portion of the absorbent element contains a hot melt adhesive which further comprises:

55 about 10% to about 50% of a block copolymer;  
about 20% to about 80% of a tackifying resin; and  
about 1% to about 60% of an aqueous liquid-absorbing polymer.

EP 1 013 291 A1

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

- 5 Fig. 1 is a top plan view of a sanitary napkin having a pattern coating.
- Figs. 2 is a side view of the sanitary napkin in Figure 1 taken through line A-A showing the adhesive applied between a cover layer and an absorbent element.
- 10 Fig. 3 is a top plan view of a sanitary napkin having a zone coating.
- Fig. 4 is a top plan view of a sanitary napkin having a foamed adhesive in a pattern which forms side and end gaskets.
- 15 Fig. 5 is a side view of the sanitary napkin of Figure 4 taken through line B-B showing the adhesive applied on an upper surface of a cover layer of the napkin.
- Fig. 6 is a top plan view of a sanitary napkin having a multi-line adhesive pattern.
- 20 Fig. 7 is a side view of the sanitary napkin of figure 6 taken through line C-C showing the adhesive applied between a barrier layer and an absorbent element.
- Fig. 8 is a top plan view of a sanitary napkin having adhesive applied in a curved line pattern adjacent each longitudinal side edge and transverse end region of the napkin.
- 25 Fig. 9 is a top plan view of a sanitary napkin having adhesive applied in a curved line pattern which forms a closed perimeter around a center region of the sanitary napkin.
- 30 Fig. 10 is a top plan view of a sanitary napkin having adhesive applied in an hour glass pattern in a central region of the napkin.
- Fig. 11 is a top plan view of a sanitary napkin having adhesive applied as a pair of substantially parallel lines adjacent each longitudinal side edge of the napkin.
- 35 Fig. 12 is a side view of the sanitary napkin of Figure 11 taken through lines D-D of Figure 11 showing the adhesive applied between a cover layer and an absorbent element of the napkin.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

- 40 [0013] The present invention relates to hot melt adhesives, and more particularly to hot melt adhesives which are useful in the construction of absorbent articles such as catamenial pads, diapers, breast pads, surgical pads and bandages. Unlike traditional hot melt adhesives that are hydrophobic in nature, the hot-melt adhesives of the present invention readily absorb aqueous fluids such as saline and menstrual fluid. The hot melt adhesives of the present invention are formed from a blend of about 10% to about 50% of a block copolymer; about 20% to about 80% of a tackifying resin; and about 1% to about 60% of an aqueous liquid-absorbing polymer. The hot melt adhesives of the present invention may optionally contain absorbent thermoplastic polymers, super absorbent particles, tackifiers and plasticizers.
- 45 [0014] In a preferred embodiment, the hot melt adhesives of the present invention comprise (by weight):

- 50 ~~about 10 - 50% block copolymer;~~  
~~about 20 - 80% tackifying resin;~~  
X ~~about 1 - 60% aqueous liquid absorbing polymer;~~  
~~about 0 - 40% plasticizer; and~~  
about 0 - 2.0% antioxidant.

- 55 [0015] Suitable block copolymers for use in the invention include linear or radial co-polymer structures having the formula  $(A-B)_x$  wherein block A is a polyvinylarene block, block B is a poly(monoalkenyl) block, x denotes the number of polymeric arms, and wherein x is an integer greater than or equal to one. Suitable block A polyvinylarenes include, but are not limited to Polystyrene, Polyalpha-methylstyrene, Polyvinyltoluene, and combinations thereof. Suitable Block

8 poly(monoalkenyl) blocks include, but are not limited to conjugated diene elastomers such as for example polybutadiene or polyisoprene or hydrogenated elastomers such as ethylene butylene or ethylene propylene or polyisobutylene, or combinations thereof. Commercial examples of these types of block copolymers include Kraton™ elastomers from Shell Chemical Company, Vector™ elastomers from Dexco, Solprene™ from Enichem Elastomers and Stereon™ from Firestone Tire & Rubber Co.

5 [0016] Suitable tackifying resins include natural and modified resins; glycerol and pentaerythritol esters of natural and modified resins; polyterpene resins; copolymers and terpolymers of natural terpenes; phenolic modified terpene resins and the hydrogenated derivatives thereof; aliphatic petroleum resins and the hydrogenated derivatives thereof; aromatic petroleum resin and the hydrogenated derivatives thereof; and aliphatic or aromatic petroleum resins and the hydrogenated derivatives thereof, and combinations thereof. Commercial examples of these types of resins include 10 Foral® hydrogenated rosin ester, Staybelite® hydrogenated modified rosin, Poly-pale® polymerized rosin, Permalyn® rosin ester, Pentalyn® rosin ester, Adtac® oil extended hydrocarbon resin, Piccopale® aromatic hydrocarbon, Piccotac®, Hercotac® aromatic modified aliphatic hydrocarbon, Regalrez® cycloaliphatic resins, or Piccolyte® from Hercules, Eselementz® from Exxon Chemical aliphatic hydrocarbon and cycloaliphatic resins, Wingtack® from Goodyear Tire & Rubber Co., synthetic polyterpene resins including aromatic modified versions, Arkon® partially and fully hydrogenated aromatic resins from Arakawa Chemicals, Zonatac® styrenated terpene resin, Zonarez® rosin ester and Zonester® rosin ester from Arizona Chemical and Nevtacon® aromatic modified aliphatic hydrocarbon from Neville Chemical Company.

15 [0017] Suitable aqueous liquid absorbing polymers include thermoplastic hydrogels such as superabsorbent materials or thermoplastic polymeric compositions, which are formed from a water-soluble soft segment and one or more hard segments. The hard segment must melt processable, i.e. at use temperature the hard segments in the polymer are below their melt temperature, and at process temperature, the hard segments are above their melting point temperature and below the decomposition temperature of either the other components of the hot-melt adhesive composition. The hard segment is substantially insoluble in water, and phase separates from the soft segment. Examples of suitable 20 hard segments include, but are not limited to polyurethane, polyamides, polyesters, polyureas, and combinations thereof. Examples of suitable soft segments include, but are not limited to polyethylene oxide, polyvinyl alcohol, polyvinyl pyrrolidone, polyacrylamide, polysaccharide, polymaleic anhydride, random copolymers of polyethylene oxide and polypropylene-oxide and combinations thereof. The soft and hard segments may be covalently bonded together by means of urethane, amide, ester, or secondary urea linkages or combinations thereof. Examples of aqueous liquid 25 absorbing thermoplastic polymeric compositions which are commercially available include hydrophilic polyurethane from Tyndale Plains-Hunter Ltd. and Aquacaulk® thermoplastic polymers from Sumitomo Seika Chemicals Co., Ltd. [0018] Suitable superabsorbent materials include any of the conventional superabsorbent particles or superabsorbent fibers which are commercially available today. The superabsorbent material is preferably a superabsorbent particle having an average particle size less than 150 microns. An example of which is Aquakeep® J-550P from Absorbent 30 Technologies Inc.

35 [0019] Suitable plasticizers for use in the present invention generally will include any conventional plasticizers which decrease hardness and modulus, enhance pressure sensitive tack and reduce melt and solution viscosity. It is preferred that the plasticizer be water soluble or water dispersible or alternatively be a wax-like substance such as polyethylene glycol, glycerin, glycerol, polypropylene glycol, butylene glycol or sorbitol. An example of a preferred plasticizer is Carbowax® polyethylene glycol from Union Carbide.

40 [0020] Suitable anti-oxidants for use in the present invention include any conventional anti-oxidants, and are preferably hindered phenols such as for example Ethanol 330™ 1,3,5-trimethyl-2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl) benzene which is commercially available from the Ethyl Corporation.

45 [0021] The hot melt adhesives of the present invention may be formed by blending the block copolymer, the tackifying resin and the aqueous liquid-absorbing polymer in a suitable adhesive processing equipment such as a melt mixer or extruder at a temperature above their respective melting points until uniformly mixed. The hot melt adhesive may be applied to substrates using conventional adhesive application equipment such as a hot melt adhesive slot coating head, a hot melt adhesive swirl spray applicator (a commercial example of which is a Nordson Control Fiberization®), using a hot melt adhesive micro fiber applicator (commercial examples of these applicators include Nordson Control Coat®, ITW Dynafiber®, J&M Meltbrown, and May Coating's Accufiber®), using a hot melt adhesive rotary screen applicator to create a pattern coating (examples of this equipment include Nordson and Kraemer rotary screen technology).

50 [0022] Referring to Figure 1, there is shown an absorbent article, which for purposes of illustration is a sanitary napkin 1 having opposite longitudinal sides 2, 3 and opposite transverse ends 4, 5. Referring to Figure 2, the sanitary napkin 1 of Figure 1 is shown in cross section, having an upper, body facing, cover layer 10, a lower garment facing, barrier layer 20 and absorbent element 30 between the cover layer 10 and barrier layer 20. Liquid absorbing hot melt adhesive 40 adheres the cover layer 10 to the absorbent element 30 in a pattern coated absorbency zone 50 in a substantially rectangular pattern. The hot melt adhesive may alternatively be located between the absorbent element 30 and the barrier layer 20 (not shown). Other adhesive patterns and application locations are illustrated in Figures 3 to 12.

[0023] For example, Figure 3, shows a top plan view of an absorbent article 301 having cover layer 310, opposite longitudinal sides 302, 303 in an hour-glass configuration and opposite transverse ends 304, 305. Liquid absorbing hot melt adhesive 40 is zone coated in absorbency zone 350 in a substantially rectangular pattern.

[0024] In the embodiment of the invention illustrated in Figures 4 and 5, there is shown sanitary napkin 401 having cover layer 410, barrier layer 410, absorbent element 430, transfer layer 470, and aqueous liquid absorbing hot melt adhesive 440 which has been foamed by mixing the adhesive with an inert gas. The foamed adhesive is then metered and dispensed through a nozzle onto a substrate, in this case the cover layer of a sanitary napkin. This technology is commercially available from the Nordson Corporation using their FoamMelt® processors and is disclosed more fully in Dilnik et al., U.S. Patent No. 5,807,367, which is incorporated herein in its entirety. As shown in Figure 4, the foamed hot melt adhesive 440 has been applied to the body facing cover layer adjacent the longitudinal sides of the sanitary napkin 401 to form side gaskets 450, 451 and end gaskets 460, 461. The hot melt adhesive 440 may alternatively be applied between the cover layer 410 and the subjacent absorbent element 430 (not shown).

[0025] Referring to Figures 6 and 7, there is shown an absorbent article, which for purposes of illustration is a sanitary napkin 601 having opposite longitudinal sides 602, 603 and opposite transverse ends 604, 605. Referring to Figure 7, the sanitary napkin 601 of Figure 6 is shown in cross section, having an upper, body facing, cover layer 610, a lower garment facing, barrier layer 620 and absorbent element 630 between the cover layer 610 and barrier layer 620. Liquid absorbing hot melt adhesive 640 adheres the barrier layer 620 to the absorbent element 630 in a multi-line coated absorbency zone 650 in a substantially rectangular pattern.

[0026] Figure 8 shows a top plan view of an absorbent article 801 having cover layer 810, opposite longitudinal sides 802, 803 in an hour-glass configuration and opposite transverse ends 804, 805. Liquid absorbing hot melt adhesive 840 is applied in a curved line pattern to form opposite side absorbency zones 841, 842 and opposite transverse end absorbency zones 843, 844.

[0027] Figures 9 and 10 show top plan view of absorbent articles 901, 920, respectively, having an adhesive pattern in a substantially hour-glass shape. Figure 9 has cover layer 910, opposite longitudinal sides 902, 903 in an hour-glass configuration and opposite transverse ends 904, 905. Referring again to Figures 9 and 10, liquid absorbing hot melt adhesive 940, 960 is applied to the article to form an hour-glass shaped absorbency zone 950, 965 (respectively).

[0028] Referring to Figures 11 and 12, there is shown an absorbent article, which for purposes of illustration is a sanitary napkin 1101 having opposite longitudinal sides 1102, 1103 and opposite transverse ends 1104, 1105. Referring to Figure 12, the sanitary napkin 1101 of Figure 11 is shown in cross section, having an upper, body facing, cover layer 1110, a lower garment facing, barrier layer 1120 and absorbent element 1130 between the cover layer 1110 and barrier layer 1120. Liquid absorbing hot melt adhesive 1140 is adhered to the cover layer 1110 and to the absorbent element 1130 in a parallel line coated absorbency zone 1150.

#### Example 1

[0029] The aqueous liquid absorbing hot-melt adhesive of the present invention was evaluated for its melt viscosity, adhesive strength (peel strength as measured on a polypropylene nonwoven fabric) and ability to absorb an aqueous saline solution (absorbent capacity) relative to a conventional hot melt adhesive. The conventional hot-melt adhesive was commercially available from the Fuller Company under the tradename HL-1491™. This is a standard hot-melt adhesive that is often used in the construction of absorbent articles such as sanitary napkins, panty liners, diapers and the like. The formulation of the conventional adhesive is believed to be in the following approximate proportions:

15-20% of a styrene-isoprene-styrene block copolymer having a 30% styrene content;  
 60 - 70% aliphatic or aromatic modified aliphatic tackifying resin  
 15-20% mineral oil  
 <2% anti-oxidant  
 <2% additional adjuncts (wax and polyethylene)

[0030] Two examples of the hot-melt adhesive of the present invention had the following formulas:

#### Sample A

##### [0031]

55        5.7% block copolymer (Vector DPX-552™)  
           33.7% tackifying resin (Foral 85™)  
           10.0% aq. liquid absorbing polymer (Aquacaulk TQU-5™)  
           40.0% superabsorbent particles (Aquatek J55-P™)

EP 1 013 291 A1

10.5% plasticizer (Peg 600<sup>TM</sup>) and  
0.5% antioxidant (Ethanox 330<sup>TM</sup>).

Sample B

5

[0032]

10

15.0% block copolymer (Vector DPX-552<sup>TM</sup>)  
25.0% tackifying resin (Foral 85<sup>TM</sup>)  
0.0% aq. liquid absorbing polymer (Aquacaulk TQU-5<sup>TM</sup>)  
45.0% superabsorbent particles (Aquakeep J55-P<sup>TM</sup>)  
15.0% plasticizer (Peg 600<sup>TM</sup>) and  
0.5% antioxidant (Ethanox 330<sup>TM</sup>).

15

[0033] The results of the evaluation are provided in the following Table 1.

Table 1

20

	Commercial Sample	Sample A	Sample B
Viscosity @ 177°C, 101,000 (Centipoise)	1100	10,000	
Absorbent Capacity (g/g)	none	9.4	10.3
Peel Strength (lbs./in. width)	1.1	0.3	1.18

25

[0034] The commercially available hot-melt adhesive exhibited substantially no absorbency while the hot-melt adhesive of the present invention absorbed about 10 grams of liquid per gram of adhesive. Moreover, the adhesive composition of the present invention experienced no diminution of its adhesive strength.

30 Claims

1. A hot-melt adhesive that is capable of absorbing aqueous liquids which comprises:

35

about 10% to about 50% of a block copolymer;  
about 20% to about 80% of a tackifying resin; and  
about 1% to about 60% of an aqueous liquid-absorbing polymer.

40

2. The hot-melt adhesive according to claim 1 wherein the block copolymer is a linear or radial co-polymer structure having the formula  $(A-B)_x$  wherein block A is a polyvinylarene block, block B is a poly(monoalkenyl) block, x denotes the number of polymeric arms, and wherein x is an integer greater than or equal to one.

45

3. The hot-melt adhesive according to claim 2 wherein the block A polyvinylarenes is selected from the group consisting of Polystyrene, Polyalpha-methylstyrene, Polyvinyltoluene, and combinations thereof and wherein the Block B poly(monoalkenyl) blocks are selected from the group consisting of conjugated diene elastomers, hydrogenated elastomers and combinations thereof.

50

4. The hot-melt adhesive according to claim 3 wherein the conjugated diene elastomers are selected from the group consisting of polybutadiene and polyisoprene and wherein the hydrogenated elastomers are selected from the group consisting of ethylene butylene, ethylene propylene, polyisobutylene and combinations thereof.

5. The hot-melt adhesive according to claim 1 wherein the hot melt adhesive further contains absorbent thermoplastic polymers, super absorbent particles, tackifiers and plasticizers.

55

6. The hot-melt adhesive according to claim 1 wherein the tackifying resins are selected from the group consisting of natural resins, modified resins, glycerol esters of natural resins, glycerol esters of modified resins, pentaerythritol esters of natural resins, pentaerythritol esters of modified resins; polyterpene resins, copolymers of natural terpenes, terpolymers of natural terpenes, phenolic modified terpene resins and hydrogenated derivatives thereof, aliphatic petroleum resins and hydrogenated derivatives thereof, aromatic petroleum resin and hydrogenated deriv-

**EP 1 013 291 A1**

atives thereof, aliphatic petroleum resins, hydrogenated derivatives of aliphatic petroleum resins, aromatic petroleum resins, hydrogenated derivatives of aromatic petroleum resins, and combinations thereof.

- 5      7. The hot-melt adhesive according to claim 1 wherein the aqueous liquid absorbing polymers is selected from the group consisting of thermoplastic hydrogels and thermoplastic polymeric compositions which are formed from a water-soluble soft segment and one or more hard segments.
- 10     8. The hot-melt adhesive according to claim 7 wherein the hard segments are selected from the group consisting of polyurethane, polyamides, polyesters, polyureas, polypropylene oxide and combinations thereof.
- 15     9. The hot-melt adhesive according to claim 7 wherein the soft segments are selected from the group consisting of polyethylene oxide, polyvinyl alcohol, polyvinyl pyrrolidone, polyacrylamide, polyaccharide, polymaleic anhydride, and random copolymers of polyethylene oxide and polypropylene-oxide.
- 20     10. An absorbent article comprising a liquid permeable topsheet, a liquid impermeable barrier sheet, an absorbent element between the topsheet and the barrier sheet, wherein either the topsheet or the barrier sheet is adhered to the absorbent element with a hot melt adhesive which further comprises:
  - about 10% to about 50% of a block copolymer;
  - about 20% to about 80% of a tackifying resin; and
  - about 1% to about 60% of an aqueous liquid-absorbing polymer.
- 25     11. An absorbent article comprising a liquid permeable topsheet, a liquid impermeable barrier sheet, an absorbent element between the topsheet and the barrier sheet, wherein at least a portion of the absorbent element contains a hot melt adhesive which further comprises:
  - about 10% to about 50% of a block copolymer;
  - about 20% to about 80% of a tackifying resin; and
  - about 1% to about 60% of an aqueous liquid-absorbing polymer.

30

35

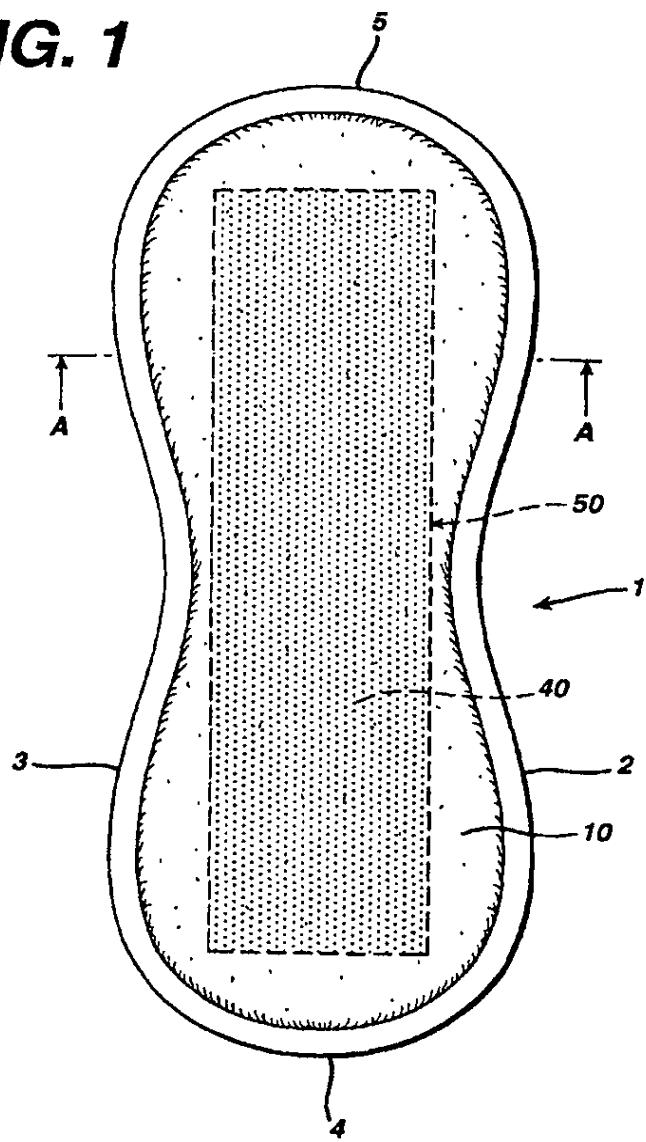
40

45

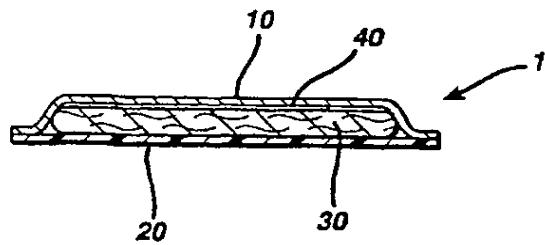
50

55

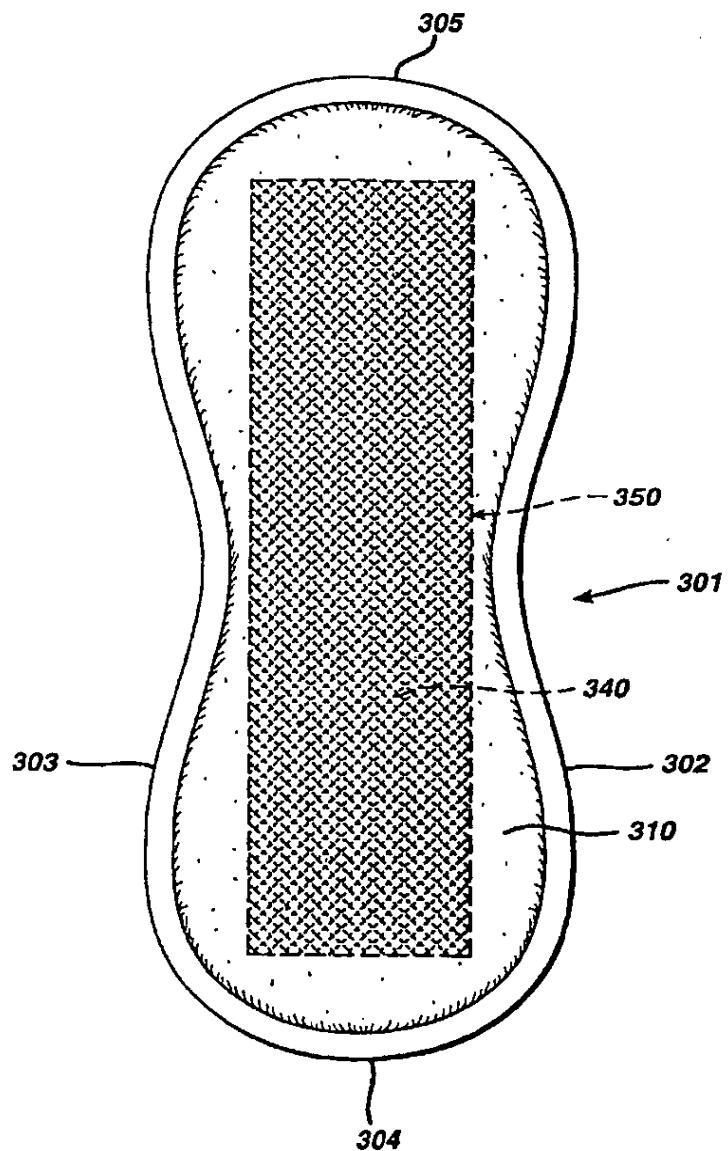
**FIG. 1**



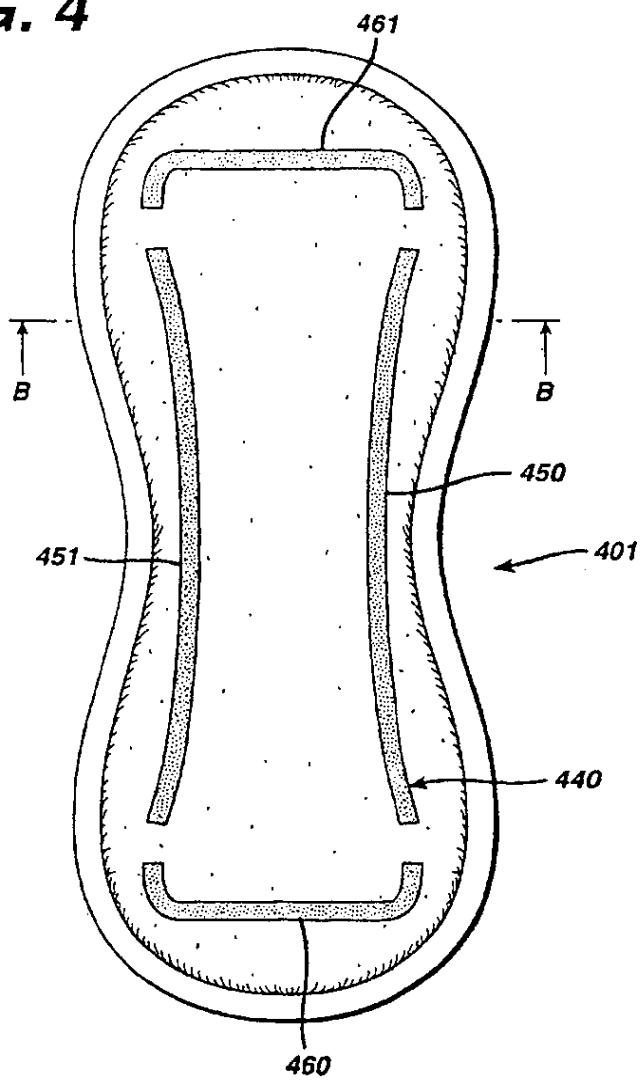
**FIG. 2**



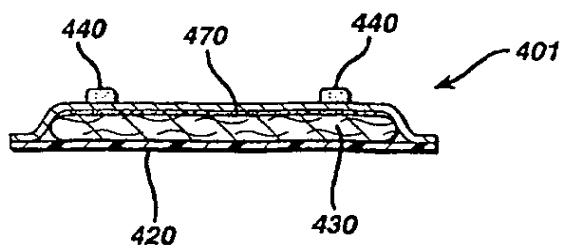
**FIG. 3**



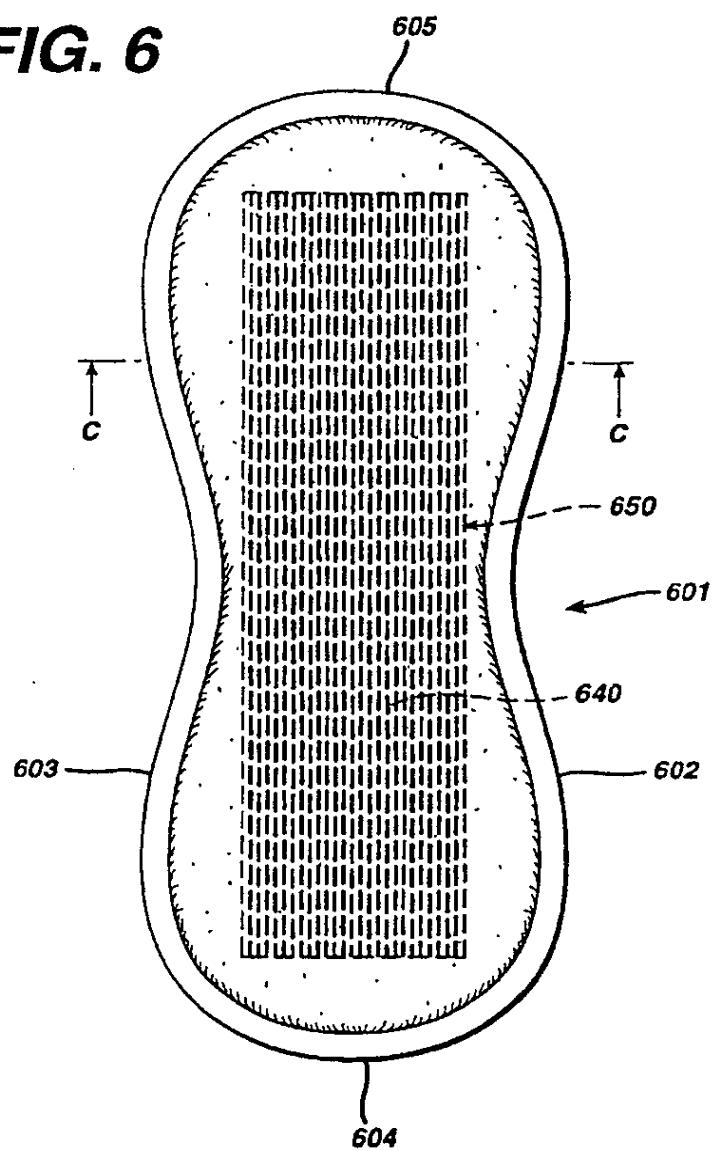
**FIG. 4**



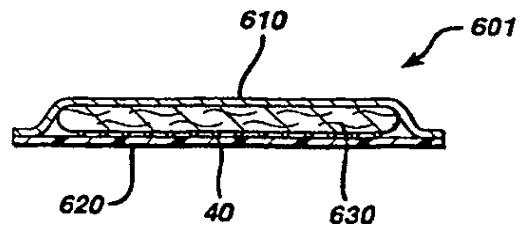
**FIG. 5**



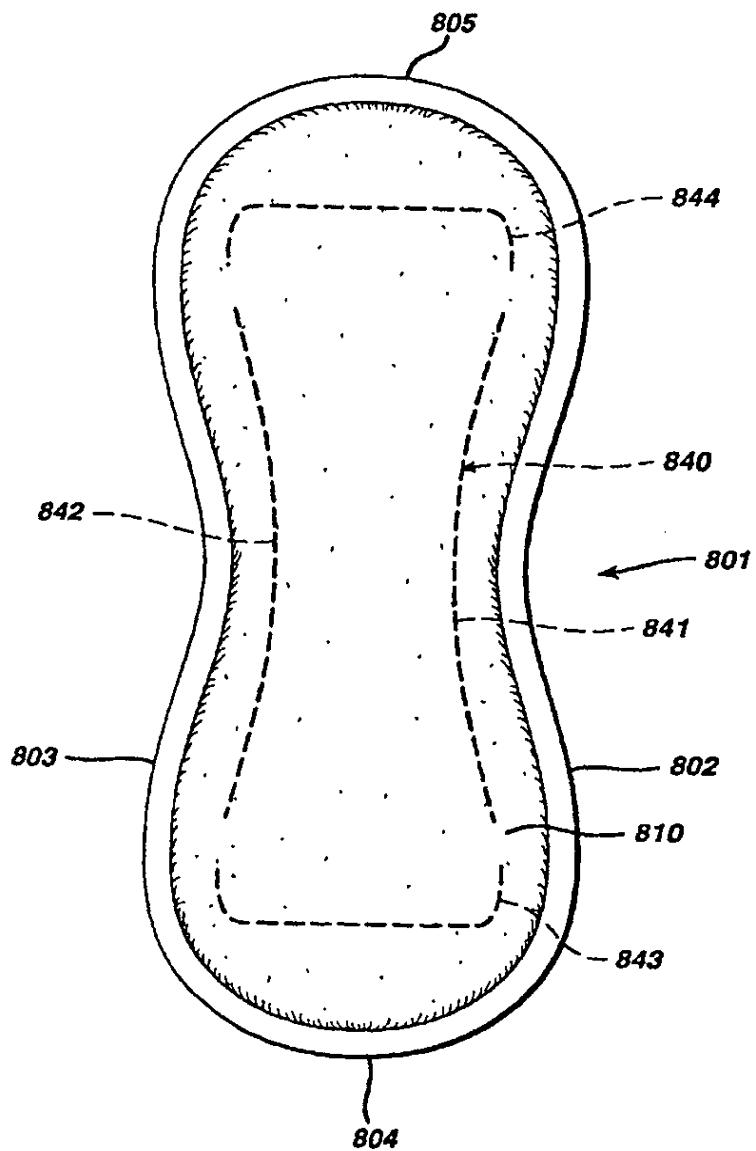
**FIG. 6**



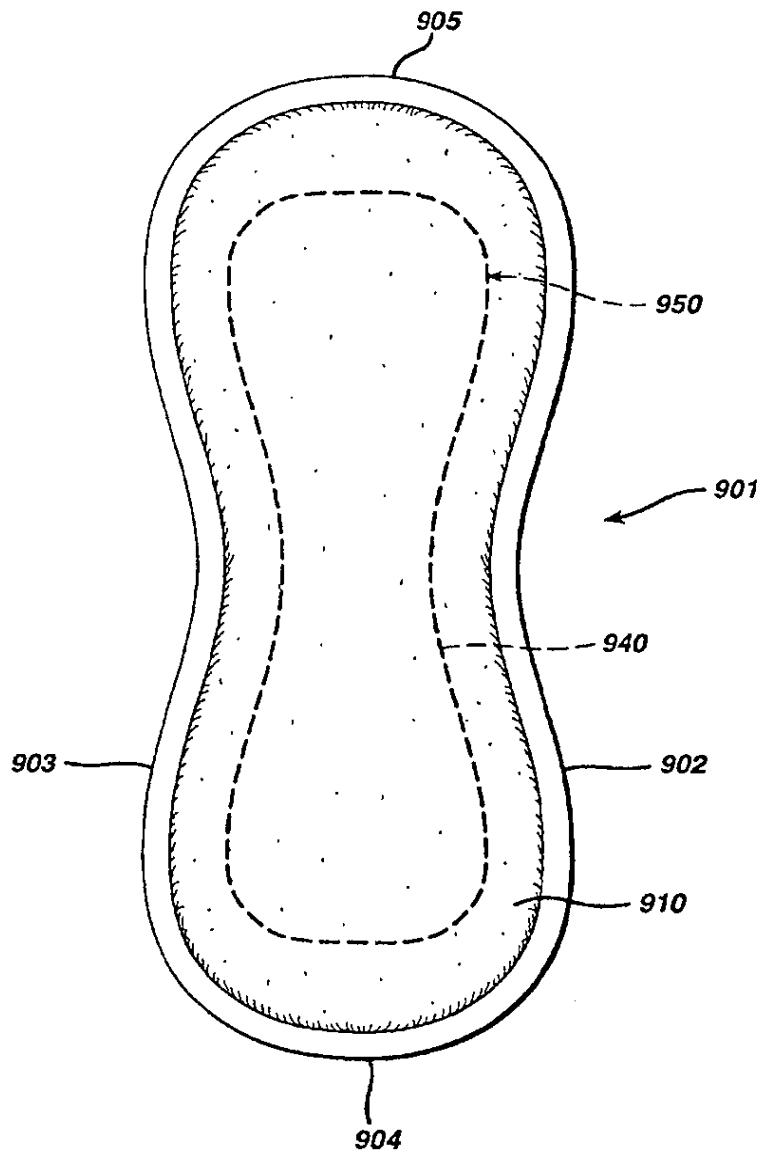
**FIG. 7**



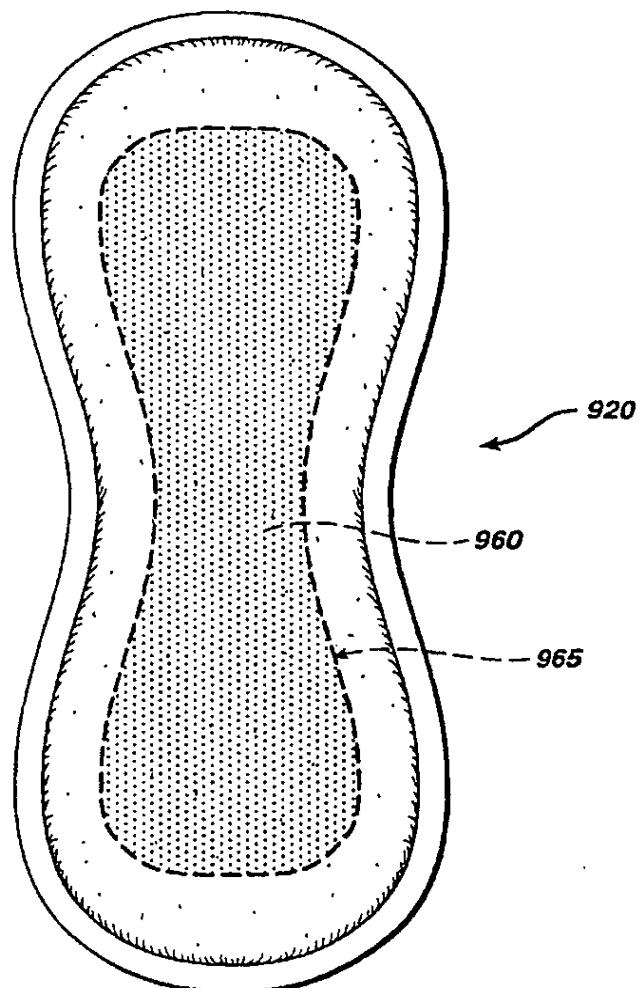
**FIG. 8**



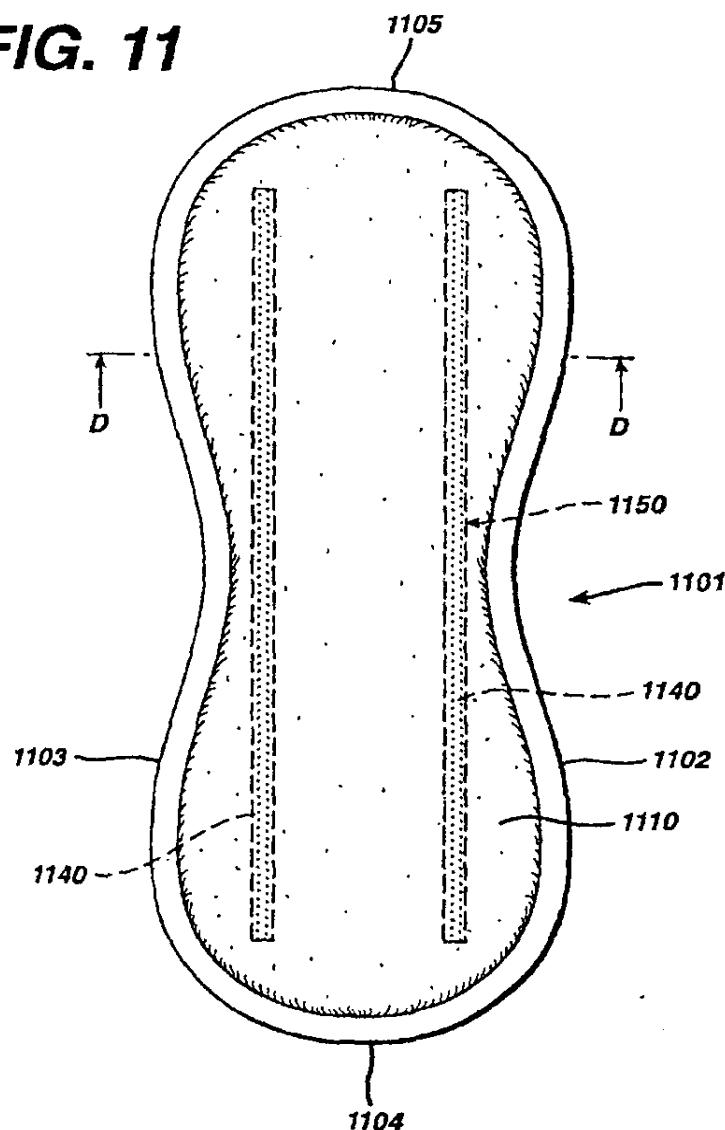
**FIG. 9**



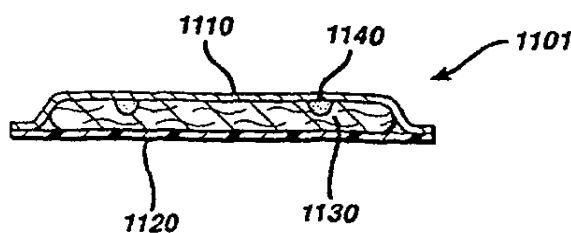
**FIG. 10**



**FIG. 11**



**FIG. 12**





European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.)		
X	EP 0 658 351 A (MCNEIL PPC INC) 21 June 1995 (1995-06-21)	1-6,10, 11	A61L15/58 A61L15/60		
Y	* abstract * * page 3, line 1-7 * * page 4, line 14-54 * * page 5, line 21-37 * * page 8, line 13-27 *	1-11			
Y	EP 0 802 251 A (HERCULES INC) 22 October 1997 (1997-10-22)	1-11			
	* abstract * * page 2, line 7-9 * * page 6, line 29-49 * * page 7, line 21-29 * * page 8, line 13 * * page 9, line 15-30 * * page 11, line 3-10 * * page 12, line 54,55 *				
A	US 5 503 919 A (LITCHHOLT JOHN J ET AL) 2 April 1996 (1996-04-02)	1-4,6, 10,11			
	* abstract * * column 1, line 9-13 * * column 3, line 7-24 * * column 16, line 17-35 * * column 24, line 47 - column 25, line 34 * * column 30, line 29-49; examples * * claims 1,2,5 *		TECHNICAL FIELDS SEARCHED (Int.Cl.)  A61L A61F		
A	US 5 750 623 A (DIEHL CHARLES F ET AL) 12 May 1998 (1998-05-12)	1-6,10, 11			
	* abstract * * column 7, line 9-20 * * column 8, line 5-23 *				
		-/-			
The present search report has been drawn up for all claims					
Place of search	Date of completion of the search	Examiner			
THE HAGUE	29 March 2000	Böhm, I			
CATEGORY OF CITED DOCUMENTS					
X : particularly relevant if taken alone	T : theory or principle underlying the invention				
Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date				
A : technological background	D : document cited in the application				
O : non-written disclosure	L : document cited for other reasons				
P : intermediate document	R : member of the same patent family, corresponding document				

European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 99 12 5404

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.)
A	US 5 372 870 A (DIEHL CHARLES F ET AL) 13 December 1994 (1994-12-13) * abstract * * column 1, line 18-31 * * column 2, line 55-65 * * column 3, line 14-33 * * column 6, line 1-17 *	1-6, 10, 11	
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	29 March 2000	Böhm, I	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 12 5404

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-03-2000

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0658351	A	21-06-1995	US 5462538 A AT 171627 T CA 2137513 A DE 69413653 D DE 69413653 T ES 2123087 T JP 7194651 A US 5681305 A	31-10-1995 15-10-1998 17-06-1995 05-11-1998 11-03-1999 01-01-1999 01-08-1995 28-10-1997
EP 0802251	A	22-10-1997	CA 2202192 A CN 1172839 A JP 10046128 A	15-10-1997 11-02-1998 17-02-1998
US 5503919	A	02-04-1996	US 5342858 A AT 169952 T AU 7313194 A CA 2164812 A DE 69412621 D DE 69412621 T EP 0706547 A ES 2119217 T JP 8512076 T WO 9501408 A	30-08-1994 15-09-1998 24-01-1995 12-01-1995 24-09-1998 25-02-1999 17-04-1996 01-10-1998 17-12-1996 12-01-1995
US 5750623	A	12-05-1998	CA 2252756 A EP 0900258 A WO 9744404 A	27-11-1997 10-03-1999 27-11-1997
US 5372870	A	13-12-1994	US 5292819 A US 5143968 A AU 2145092 A DE 69223783 D DE 69223783 T EP 0588923 A ES 2110502 T JP 6509595 T WO 9220725 A US 5399627 A AT 112795 T AU 635559 B AU 6186890 A CA 2037926 A DE 69013321 D EP 0438576 A ES 2061060 T JP 4501285 T	08-03-1994 01-09-1992 30-12-1992 05-02-1998 10-06-1998 30-03-1994 16-02-1998 27-10-1994 26-11-1992 21-03-1995 15-10-1994 25-03-1993 11-03-1991 12-02-1991 17-11-1994 31-07-1991 01-12-1994 05-03-1992

EPO FORM P1050  
For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 12 5404

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
 The members are as contained in the European Patent Office EDP file on  
 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-03-2000

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5372870 A		KR	150188 B	01-10-1998
		NO	911394 A	04-06-1991
		WO	9102039 A	21-02-1991
		US	5358783 A	25-10-1994
		US	5292806 A	08-03-1994
		US	5266394 A	30-11-1993